



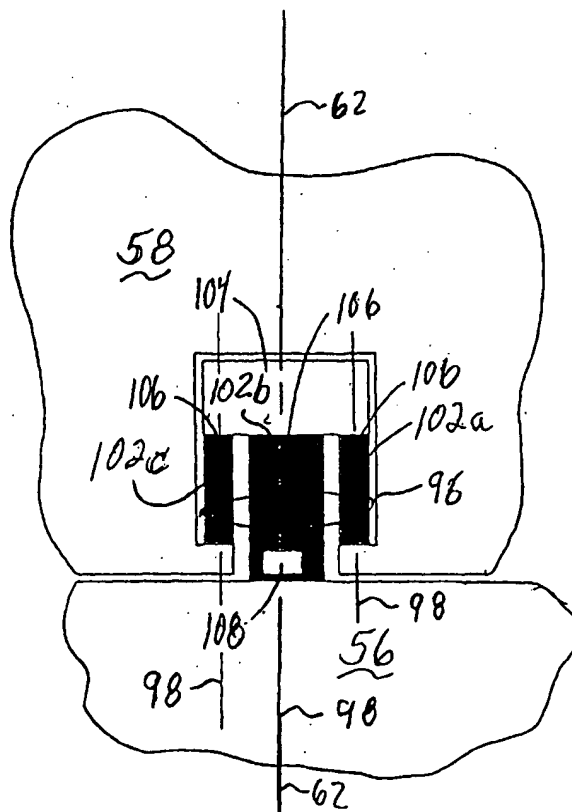
## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<b>(51) International Patent Classification <sup>7</sup> :</b>  <b>G02B 26/08, G01P 15/08, G01C 19/00</b>	<b>A3</b>	<b>(11) International Publication Number:</b> <b>WO 00/13210</b>  <b>(43) International Publication Date:</b> 9 March 2000 (09.03.00)
<b>(21) International Application Number:</b> PCT/US99/20218  <b>(22) International Filing Date:</b> 2 September 1999 (02.09.99)  <b>(30) Priority Data:</b> 60/098,881      2 September 1998 (02.09.98)      US 60/144,953      21 July 1999 (21.07.99)      US  <b>(71) Applicant:</b> XROS, INC. [US/US]; 750 N. Pastoria Avenue, Sunnyvale, CA 94086-3522 (US).  <b>(72) Inventors:</b> SLATER, Timothy, G.; 1032 Irving Street, San Francisco, CA 94122 (US). NEUKERMANS, Armand, P.; 3510 Arbutus Avenue, Palo Alto, CA 94303 (US).  <b>(74) Agent:</b> SCHREIBER, Donald. E.; P.O. Box 64150, Sunnyvale, CA 94088-4150 (US).	<b>(81) Designated States:</b> CA, JP, KR, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).  <b>Published</b> <i>With international search report.</i>  <b>(88) Date of publication of the international search report:</b> 15 June 2000 (15.06.00)	

**(54) Title:** MICROMACHINED MEMBERS COUPLED FOR RELATIVE ROTATION BY TORSIONAL FLEXURE HINGES

**(57) Abstract**

A monolithically fabricated micromachined structure couples a reference frame (56) to a dynamic plate (58). Performance of torsional oscillators or scanners benefits greatly by coupling the frame (56) to the plate (58) with folded torsional flexure hinges (96) rather than torsion bars. A folded torsion flexure hinge (96) for supporting the plate (58) from the frame (56) is made up of three basic hinge segments (102a, 102b, 102c). Each basic hinge segment (102a, 102b, 102c) has a longitudinal axis (98) which is not oriented perpendicular to the rotation axis (62) of the plate (58). An intermediate region (104) of the folded torsional flexure hinge (96) couples together immediately adjacent ends (106) of the basic hinge segments (102a, 102b, 102c). A basic hinge segment (102b) may include a torsion sensor (108) for measuring angular rotation of the plate (58) about axis (62) with respect to the frame (56).



**FOR THE PURPOSES OF INFORMATION ONLY**

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece			TR	Turkey
BG	Bulgaria	HU	Hungary	ML	Mali	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MN	Mongolia	UA	Ukraine
BR	Brazil	IL	Israel	MR	Mauritania	UG	Uganda
BY	Belarus	IS	Iceland	MW	Malawi	US	United States of America
CA	Canada	IT	Italy	MX	Mexico	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NE	Niger	VN	Viet Nam
CG	Congo	KE	Kenya	NL	Netherlands	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NO	Norway	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	NZ	New Zealand		
CM	Cameroon			PL	Poland		
CN	China	KR	Republic of Korea	PT	Portugal		
CU	Cuba	KZ	Kazakhstan	RO	Romania		
CZ	Czech Republic	LC	Saint Lucia	RU	Russian Federation		
DE	Germany	LI	Liechtenstein	SD	Sudan		
DK	Denmark	LK	Sri Lanka	SE	Sweden		
EE	Estonia	LR	Liberia	SG	Singapore		

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/US99-20218

**A. CLASSIFICATION OF SUBJECT MATTER**

IPC(7) :G02B 26/08; G01P 15/08; G01C 19/00

US CL :250/216; 73/504.2, 504.12, 504.12, 504.14, 514.01, 514.38

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

U.S. : Please See Extra Sheet.

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A, P	US 5,905,201 A (PETRI) 18 MAY 1999 (18/05/99), see entire document.	1-81
A	US 5,760,305 A (GREIFF) 02 JUNE 1998 (02/06/98), see entire document.	1-81
A	US 5,650,568 A (GREIFF ET AL) 22 JULY 1997 (22/07/97), see entire document.	1-81
A	US 5,635,739 A (GREIFF ET AL) 03 JUNE 1997 (03/06/97), see entire document.	1-81

<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/> See patent family annex.	
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family
Date of the actual completion of the international search 31 MARCH 2000	Date of mailing of the international search report 14 APR 2000
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer JOHN LEE Telephone No. (703) 308-0956

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US99-20218

## B. FIELDS SEARCHED

Minimum documentation searched

Classification System: U.S.

250/216; 73/504.2, 504.12, 504.12, 504.14, 514.01, 514.38; 250/234, 235, 236, 231.1, 231.13; 73 504.3, 504.4, 504.15,  
514.02, 514.16, 514.26, 514.29